Space Weather Technical Forecast

Issued on Friday, 11 November 2022 at 01:20 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight Chance of isolated M-class flares (R1-R2/Minor to Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with occasional C-class flares, the largest of which was a C1.4 flare at 10/2141 UTC, from AR3141. There are three numbered regions on the visible disc, with AR3141 remaining the most complex and largest of the regions, recently developing into an Eki/Beta-Gamma-Delta classification. AR3140 also showed some development, and is now classified as Cso/Beta due to the emergence of some small and faint trailing spots. The remaining region, newly numbered AR3145, is a small and simple Bxo/Beta group.

No Earth-directed CMEs have been observed on available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1, persisted at background levels, with wind speeds generally varying between 310/340 km/s. Density showed a slight upward trend from below average levels to average. Total magnetic field strength (IMF) has been weak, 6nT or lower. The north-south component, Bz, was predominantly positive. Phi angle was initially positive (away from the Sun), and again at the end of the day, with a prolonged period of becoming negative (towards the Sun) in-between. Geomagnetic activity was Quiet (Kp 0-1).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2 MeV) at GOES-16 was initially at background levels, but then steadily increased to reach High levels, at the peak of the diurnal cycle, reaching 1334 pfu at 10/1915UTC. Electron fluence levels also showed a rising trend but remain well below Active levels. Observed fluence at 11/0001 UTC was 5e7 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to predominantly be at Low levels, with a slight chance of M-Class activity. However, over the next few days, three returning active regions are due to potentially rotate across the limb. Therefore the probability of a significant flare is likely to increase over the coming days, once the expected regions rotate onto the visible disc.
Solar Wind / Geomagnetic Activity: Geomagnetic activity is expected to be mainly Quiet to Unsettled (Kp 1-3). There is a chance of Active (Kp 4) intervals during the period, and a slight chance of G1/Minor Storms (Kp 5) on days 1 and 2 (11 & 12 Nov) if weak coronal hole connections occur.

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Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) observed by GOES-16 is expected to remain at background levels. Electron flux is forecast to be at moderate to high (1e3 pfu) levels through the period, particularly during diurnal peaks. Fluence values are likely to exceed the Active level threshold on day 1 (11 Nov) with a chance of remaining above Active through the remainder of the period.

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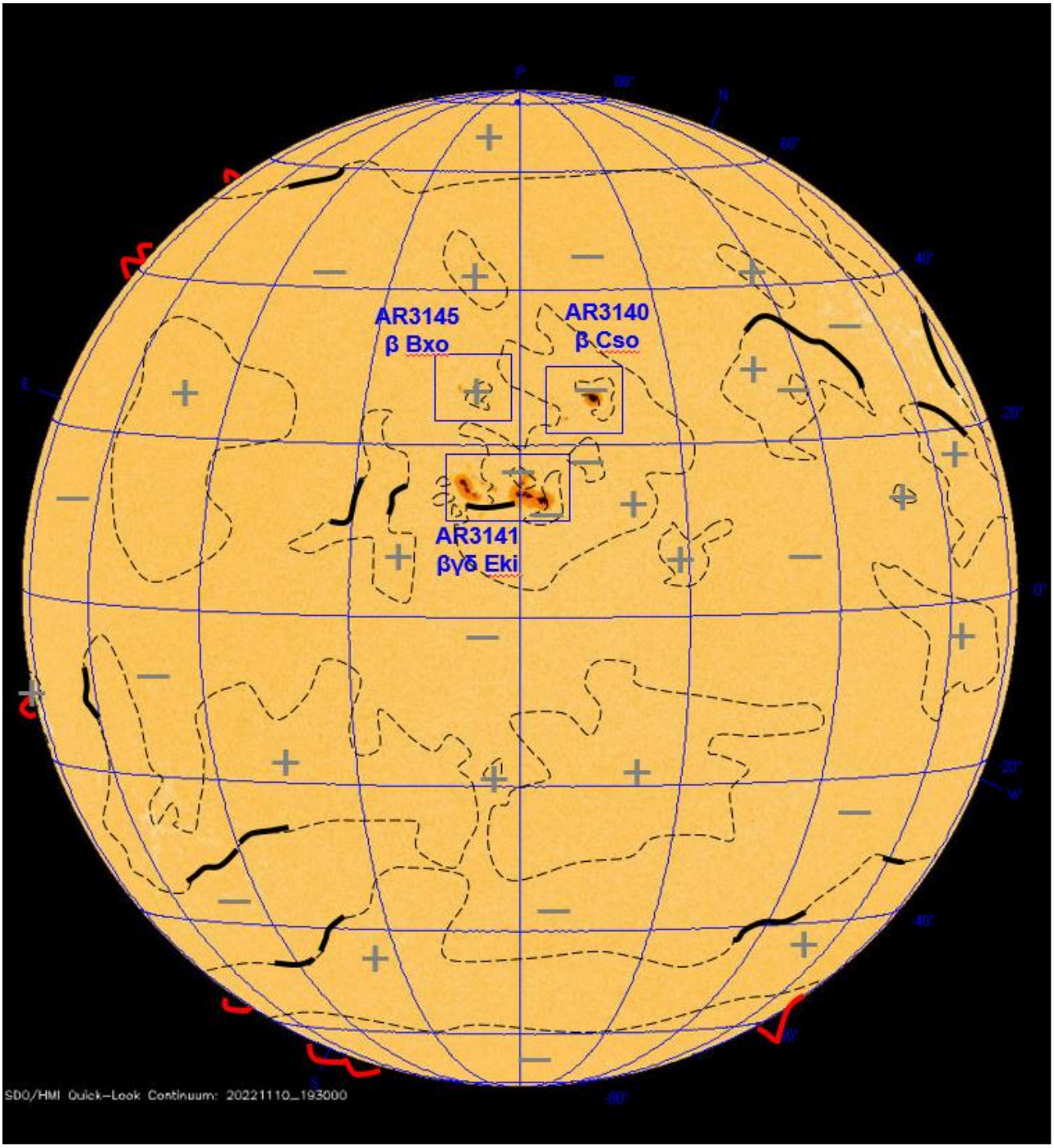
Figure 1. Solar Analysis Valid 10/1930 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are currently forecast.

Solar winds are currently at slow-ambient levels. There is a chance over the next 24hrs of some weak coronal hole connection from previously visible coronal holes, which could contribute to occasional slight increases in wind strength to slightly elevated levels on day 1 (11 Nov) and day 2 (12 Nov).

Geomagnetic activity is expected to be mainly Quiet to Unsettled. There is a chance of Active intervals during the period, and a slight chance of G1/Minor Storms on days 1 and 2 (11 & 12 Nov) if weak coronal hole connections occur.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

Solar activity is expected to predominantly be at Low levels, with a slight chance of M-Class activity, this most likely from complex region AR3141 Eki/Beta-Gamma-Delta. The remaining regions on the visible disc are far less likely to produce significant flares. However, over the next few days, three returning active regions are due to potentially rotate across the limb. Therefore the probability of a significant flare is likely to increase over the coming days, once the expected regions rotate onto the visible disc.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	5	5	5	5

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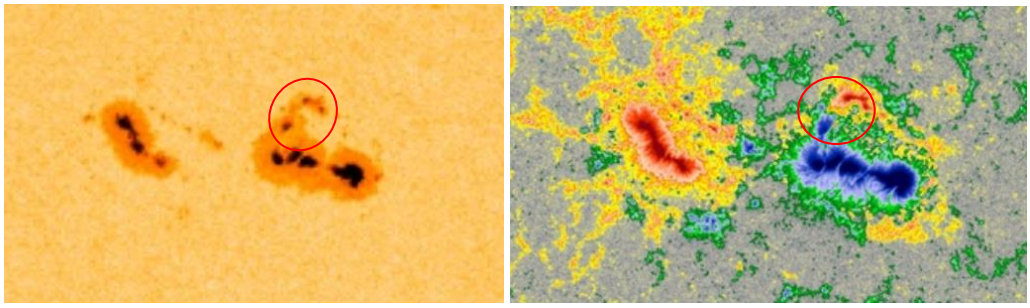
Figure 2: Latest SDO Intensitygram (left) and magnetogram (right) showing the delta spot within AR3141.



Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background levels and is forecast to remain at this level throughout the period. As AR3141 moves into a more geoeffective position from 12 Nov, however, the probability of proton storms sees a very minor increase.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	5	5	5
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Electron flux (greater than 2MeV) is currently at moderate levels. Electron flux is forecast to be at moderate to high (1e3 pfu) levels through the period, particularly during diurnal peaks. Flux values apparently recovering to those observed prior to a spell of geomagnetic activity on 7 Nov, with no significant geomagnetic activity expected to suppress this trend.
Electron fluence values are below the Active (1e8 integrated pfu) threshold. Observations have shown a rising trend, with fluence values likely to exceed the Active level threshold on day 1 (11 Nov) with a chance of remaining above Active through the remainder of the period.
The MetOffice REFM model is showing a slightly increasing trend through day 1, however at values much lower and a slower rate of incline than that which are presently being observed. Therefore the guidance is currently considered to be poor.

GEO Electron Environment	Level (cm^{-2} sr^{-1}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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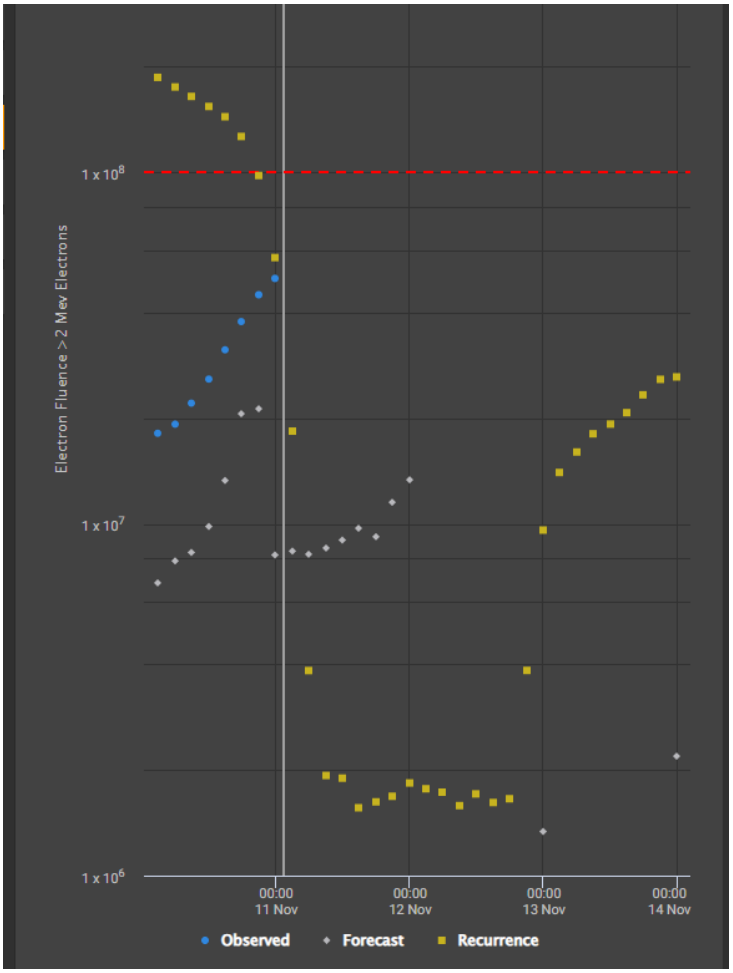
Probability (Exceedance)	day^{-1})	(Yes/No)	(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ 1x10^{8}**	No	60	50	40	20
Very Active	**≥ 2 MeV ≥ 1x10^{9}**	No	1	1	1	1

Figure 3: Latest Met Office REFM Model



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